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ABSTRACT

The identification of administrative authorities and the development of associated procedures for registering and accessing names and addresses of communications data systems are considered in this paper. It is noted that, for data communications systems using standards based on the Open Systems Interconnection (OSI) Reference Model specified by the International Telegraph and Telephone Consultative Committee (CCITT), many of the technical standards are in place, but the international and American administrative authorities and procedures are not. It is suggested that the hierarchical administrative organization employed by the CCITT in OSI specifications is the model that ought to be applied. The concepts of naming, addressing, the OSI model, and OSI registration authorities are introduced, and current work in the United States on national registration authority procedures for OSI is summarized. Discussions of differences between telephony and data and the need for proper procedures for registration and identification of registration authorities in the United States conclude the paper. (23 references) (EW)

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Registering Names and Addresses for Information Technology

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1. Introduction

To communicate, we need to know the name and address of the destination person, machine or organization. Furthermore, in communications, a name or an address must unambiguously identify a unique object to avoid misdelivery. Administrative procedures and administrators for assigning and registering names and addresses are necessary. Humans and machines need to obtain from directories the names and addresses of the computer systems with which they may wish to exchange information. For data communication systems using standards based on the Open Systems Interconnection (OSI) Reference Model[1] specified by the International Organization for Standardization (ISO) and the International Telegraph and Telephone Consultative Committee (CCITT), many of the technical standards are in place. But the international and the American administrative authorities and procedures are not in place. To meet immediate requirements of the information technology industry and its customers, the identification of administrative authorities and the development of the associated procedures for registering names and addresses and for accessing this information are needed.

Fortunately, experience does exist in the standardization of administrative aspects of communications. As an intergovernmental body concerned with the international operation and interconnection of networks, the CCITT[2] has specified successfully the international numbering plans for the public switched telephone network/integrated services digital network (PSTN/ISDN), public data networks and telex.[3] Note that the standards for these international numbering plans preceded and was independent of OSI work efforts.[4]

Integral to the implementation of the international CCITT-defined services is the hierarchical structure used to distribute responsibility to administrators internationally, nationally, geographically and to networks. All of this is necessary to providing a public service. In OSI specifications, the advantages of hierarchical administrative organizations are supported and discussed below.

This paper brings attention to several matters in this area. The concepts of *naming, addressing, OSI,* and *OSI registration authorities* are introduced. A summary of the current work in the U.S. on national registration authority procedures for OSI follows. Pertinent conclusions are made on these activities in consideration of the environments of telephony and data.

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2. A rose by any other....

Words are powerful. They evoke a tremendous range of responses in people and computers. One class of words is names. In information technology, a name is a linguistic construct denoting a *single* object.[5] A name consists of numeric, alpha or alphanumeric characters. Just as in natural language, an object may be identified by more than one name, i.e., synonyms. A name is unambiguous but not necessarily unique.

In information technology, the term "name" is conferred to information objects. Information objects performing a communication function are communication objects. A particular form of name associated with communication objects is an address. Thus an address identifies a logical or physical communication object.

The capabilities of naming and addressing are essential to information technology. Not only must systems agree on addressing, but the names of the objects being processed must be understood and agreed before distributed processing may occur. In the remainder of this paper, the term name should be understood to encompass address.

3. OSI: an Overview

Information technology, which is the combined disciplines of information processing and computer communications, is concerned with supporting distributed processing among equipment in heterogeneous systems where information needs to be exchanged to accomplish a specific task. This differs from centralized processing in terminal-host configurations.

Over the past decade, a major thrust in information technology has been the development of OSI data communication standards in ISO and CCITT. OSI encompasses a set of communication protocols and their service specifications for distributed processing between heterogeneous systems "from different manufacturers; under different managements; of different levels of complexity; and of different ages."[6] The major application protocols of OSI support electronic mail;[7] file manipulation and transfer;[8] OSI directory;[9] transaction processing;[10] and the management of communication systems.[11] It is a vibrant area in the industry that is growing in importance as specifications are progressing from international standards into multivendor implementation agreements, procurement requests and vendors' products.[12]

OSI specifications have technical requirements for naming consistent with those stated above: unambiguity and denotation of a single object. Names may be numeric or "user-friendly" alphanumeric. These standards are written to also specify the syntax, i.e., structure, of names. A means is provided in OSI to

designate the organization assigning the name to the object.[13] A number of these documents require that the semantics, i.e., the meaning, of the name be registered, too.[14]

4. Registration Authorities

4.1. General

In OSI specifications, an entity assigning and recording unambiguous names and addresses is a registration authority. When the registration authority registers names, it is a naming authority; and when it assigns addresses, it is an addressing authority. Where an organization is registered in a hierarchy by a registration authority, the organization may in turn establish an additional level of hierarchy and establish registration (sub)authorities.[15] Organizations wishing to serve as a registration authority are not subjected to any formal requirements. Consequently, a registration authority may be a standards body, a Federal or state government, a corporation, a standard, a systems administrator or even an individual. The point here is that the registration authority is responsible in OSI for naming objects.

Registration authorities serve an administrative role and may also serve a technical role.[16] The assigning, recording, updating and dissemination of names is an administrative role. The registration authority provides a technical role when the definitions of an object are recorded with the object's name assignment. Such a practice assures that the object is entitled to be included within a particular register. Depending on the objects to be named by the registration authority, the degree of registration activity may vary between static and quite dynamic. A registration authority should be concerned with structure, capacity and backup of the register.

Emphasis needs to be placed upon the fact that each information object needing to be named requires its own registration procedures and its own registration authority.

4.2. Current Activities

In light of the preceding discussion of names, addresses, OSI and registration authorities, what organizations serve as OSI registration authorities in the United States? **To date, none!**

Even though many OSI specifications are internationally standardized, the administrative processes necessary to support the technical requirements of naming are not in place currently. As a result, customers, manufacturers and

service providers are employing short-term ad hoc schemes to meet immediate implementation requirements, only to be faced with the burden of administering names in the future.[17]

Despite the requests of government, industry and standards organizations, no organization has requested the responsibility of serving as the top level registration authority in the U.S. There have been however several organizations that have investigated this issue: the Corporation for Open Systems (COS), the National Institute for Science and Technology (NIST (formerly the National Bureau of Standards)), the American National Standards Institute (ANSI), the Standards Committee T1 - Telecommunications, the Standards Committee X3 - Information Processing Systems, and the Joint Technical Committee 1 Technical Advisory Group Advisory Committee (JTC1 TAG AC).

Registration authorities are needed now to register names conformant to OSI standards.[18] Why this matter has not been resolved is discussed in the conclusion.

5. On the Horizon

According to the jointly developed specifications of ISO and CCITT, ANSI, as the U.S. National Body in ISO, is one organization that may name some OSI objects at the top level in the U.S.[19] In the American standards community, ANSI has a unique role to play. Its responsibilities include the accreditation of standards committees and the approval but not the technical development of American National Standards. Whether ANSI may choose to serve as or to delegate the function of a U.S. registration authority is not clear. But to drive the work towards closure, ANSI requested assistance from experts in developing registration procedures for the U.S.

In studying the subject of registration authority procedures in the U.S., the JTC TAG AC recognized that agreement is necessary on (1) procedures for identifying information objects needing a registration authority in the U.S.; and (2) procedures for registering each of these identified information objects. The work under study has led to preliminary agreements on the set of information objects needing registration and a suggested draft of procedures which may be used by a registration authority for organization names in the U.S. At this time, registration procedures are under development for information objects specified in ANSI-approved American National Standards and organization names It is reasonable to expect in the future that other objects may require registration procedures.

A proposal providing guidelines which the U.S.-level registration authority may use for the registration of organization names has been developed and is summarized in the remainder of section 5.[20] It is intended that organization

names assigned at the U.S.-level shall meet several of the requirements for OSI naming. Guidelines for the use and the structure of these registered organization names also need to be developed for the U.S. OSI community.

5.1. Openness, Due Process and Fairness

A name is regarded by organizations and the government as a significant economic asset. The process of assigning a name to an organization should be accomplished in such a way that openness and due process are reasonably assured to the applicant and the public. Therefore, a public review period is needed to allow a fair determination that a particular name may be assigned to the applicant. This period enables an organization or an individual an opportunity to challenge an applicant's right to use a particular name.

5.2. Discovery Not Invention

Inventing a new naming scheme is a major undertaking and would require extensive study before achieving a consensus of opinion on the solution. One way of avoiding an arduous effort and the associated delay is to utilize an existing naming scheme. By discovering rather than inventing a naming structure, the task of implementing the proposed U.S.-level registration authority would be reduced.

Several methods are in place for the identification of organizations which provide the right to use a particular name. However, the domain within which the name is guaranteed to be unique may vary, e.g., national, state and corporate. An organization applying for a registered name should provide evidence of its right to use a name at the U.S.-level. At this time, the specific naming scheme(s) which will be accepted has not been determined.

5.3. Form and Function

The registered organization names may be used in a number of different ways. Two of the most significant uses of names are in an OSI directory system and in the OSI network-layer-address.

To support computer communications, both humans and machines will need to "look-up" or request a third party to inform them of the name of the object or system with which they wish to communicate. A name in the register and an OSI directory could be either numeric or alphanumeric. A numeric name is a random positive integer greater than 9999 and less than 10,000,000. An alphanumeric name is requested by the applicant and may contain upper and lower case letters, digits and punctuation symbols.[21]

Some organizations may wish to register multiple names such as its full name and an appropriate abbreviation(s). Applicants have the option to request the assignment of only a numeric and not an alphanumeric name.

5.4. Public Review

Organizations go to great lengths to gain the right to use a name. Certainly any organization is not legally able to use any name it chooses. In fact, some registration processes can be quite lengthy and expensive. Fairness in the registration of names to organizations can be facilitated when the process is open and accessible to all interested parties. Because alphanumeric organization names are a significant aspect of commerce, an open procedure is needed to inform the public that a particular name has been requested. Notification of requested names would be made in an appropriate publication by the registration authority for a ninety day public review period. This could help assure fairness.

In contrast, numeric names are assigned randomly by the registration authority, do not have the same commercial value associated with them and are not considered necessary to require a public comment period.

Not all organizations may wish their name to be publicly available. These organizations could request the registration authority to withhold their business name from publication when the requested organization name is issued for public comment or in the directory of registration authorities.[22]

5.5. Contested Names

A complete procedure for the registration of names needs to include a method of processing challenges to a request for the right to use a certain name. Challenges may come during or after the registration process.

During the registration process, a challenge may arise by a nearly simultaneous request for the same alphanumeric name or by a comment during the public review period. In both cases, the registration authority could inform all parties that the requested name is contested and not assign the name until notification has been received by the registration authority. Such notification may be a legal decision or another government ruling, or a letter from the challenger and the applying organization.

If the challenge occurs after the name has been registered, then there is little the registration authority could do but refer the challenging entity to the organization assigned the registered name. If notification is provided that the organization holding the registered name is no longer entitled .to use that name, then the name would no longer be assigned in the register to that organization.

5.6. Inquiry and Directory Services

Above and beyond the registration authority procedures, the registration authority may find it lucrative to offer supplemental services to the industry. Two services have been identified. The information in the register may be useful to organizations providing legal, technical and marketing services. This information may be accessible in more than one way. An inquiry service could be used by organizations wishing to determine if an alphanumeric name is already registered. A directory service listing registered organizations may be useful, too. The directory could be printed or accessible electronically.

5.7. Criteria of Eligibility and Cost

For technical reasons, it is desirable to have a hierarchical structure of OSI names in the U.S. A "tree" type structure is easier to manage and facilitates directory searches. A substantive administrative benefit of a hierarchy is that it distributes the workload across various organizations. It follows that no single organization serving as a registration authority would have the overwhelming and impossible administrative and technical responsibility of registering all OSI information objects in the U.S.

To expedite the establishment of registration procedures at the various hierarchical levels in the government, the Federal, state and territorial governments will be pre-registered. The following criteria of eligibility have been developed non-governmental organizations. They may be assigned alphanumeric and numeric names from the U.S. registration authority provided:

- the applicant offers proof of the right to use the name;
- the name is not already registered or pending registration;
- the application is correctly written; and
- the $ 5,000 application fee is included.

The registration fee serves as a surrogate for other criteria of eligibility and is intended to filter out frivolous and large numbers of applicants.

The registration authority in the U.S. is not expected to profit from this operation but instead act on a cost recovery basis. The fees are used to defray the operational expenses of supporting the registration authority. If additional monies were available, then the costs would be used to support other ANSI activities.

6. Conclusion

To the extent that the supporting registration procedures are not in place, new information technologies cannot be successfully introduced to the public-at-large, especially where the syntax and semantics of the information to be exchanged

requires the common understanding of various users and heterogeneous systems.

Several differences between telephony and data are discussed below. The technical and administrative environment of telephony is different from that of data. Over its 120 year history, telephony has emerged from a nascent technology to a mature service available throughout much of the world. Part of this advance is due to CCITT Recommendations on substantive international operational issues including public network numbering plans, routing of calls, interconnection of networks, analysis of traffic and directories. Also, in the context of this paper, international and national registration authorities have been established for several operational issues, e.g., numbering plans, maintenance of jointly operated equipment, division of revenues, directories and operator assistance. Throughout the world, telephone operations are government-owned or provided primarily by large private organizations regulated by government. This consolidation of administration of telephone operations has contributed to world-wide connectivity to provide a universal telephone service.

In contrast, the processing and communication of data is less than half as old as telephony. Universal data services are in the minds of researchers, the text of standards, and in advertisements, but they are not yet a reality. As standardization progresses both in ISO/IEC, CCITT and their national counterparts, data systems are beginning to be more open and accessible to a wider community. Today, data communications are characterized by networking rather than a private line provisioned between two systems owned by the same company.

Historically, information technology has not been regulated by governments. For the most part, manufacturers, service providers and their customers have had a carte blanche.[23] Not surprisingly, a multitude of data communication solutions have proliferated in areas such as: terminal activation/deactivation, log on and log off procedures, screen characteristics, communication configuration information such as baud rate, start/stop bits, echo, character set, half-duplex versus full-duplex and asynchronous versus synchronous. Choices such as these have utility and competitive technical and marketing advantages, but flexibility breeds incompatibility. And incompatibility is antithetical to universal information technology services.

In OSI, information technology requires obtaining or registering the names and addresses of many different objects. Many of these objects require separate registration procedures and, consequently, different registration authorities. This may place a major burden on implementors and increase the difficulty with which OSI may be deployed. If the degree of difficulty is too great, the objective of interconnection of heterogeneous systems using OSI may never be realized. In telephony today, the situation is far more simple. The PTTs and the government

regulated telephone companies not only assign unique telephone numbers, but they also provide directory services.

Of further concern is the fact that there are currently no criteria of eligibility for non-governmental organizations other than the $5,000 registration fee. It is hoped that this will not restrict organizations from entering the market now. The establishment of registration procedures at the state-level would facilitate and, hopefully, reduce the cost of registering an OSI organization name in the U.S.

Given that many governmental and non-governmental bodies are spending large amounts of money on the development of OSI specifications, prototype demonstrations and products, what reasons may there be that has let the significant issue of registration authorities remain unsolved? Implementors may think that it:

- will be done by another organization, e.g., ANSI or COS;
- provides no substantial benefit to the organization serving as the registration authority;
- is not important;
- is only implementing private systems so far;
- adversely impacts embedded systems;
- requires cooperation and centrally controlled naming and addressing of information objects;
- reduces market autonomy;
- involves substantial legal exposure;
- entails significant costs;
- is a task difficult to size; and
- is not well understood.

In all likelihood, all of these views may be at work in the marketplace.

Fortunately, several of the significant needs of the information technology community have been studied, and either standards do exist or may soon exist in such areas as registration authorities, OSI directories, the interconnection of networks, and the management of networks. The completion and implementation of this type of work may lead to a major change in the way businesses and persons communicate and perform their business activities. But until that time, near-term problems shall burden implementors and require technically unnecessary administrative changes due to the lack of proper procedures for registration and the identification of registration authorities in the United States. Perhaps the best method of solving this problem may be a U.S.-based organization with the power of a PTT or a telephone company and the attendant experience in the operational aspects of open and public communications.

1 *Information Processing Systems - Open Systems Interconnection - Basic Reference Model*, ISO 7498, 1983; *Open Systems Interconnection Reference Model for CCITT Applications*, CCITT Recommendation X.200, 1988.

2 It is a branch of a specialized agency of the United Nations, the International Telecommunications Union. *The International Telecommunications Union in a Changing World*, George A. Codding, Jr. and Anthony M. Rutkowski, Artech House, Dedham, MA, 1982.

3 *Numbering plan for the ISDN Era*, CCITT Recommendation E.164, 1988. *International numbering plan for public data networks*, CCITT Recommendation X.121, 1988. *Plan for telex destination codes*, CCITT Recommendation F.69, 1988.

4 ISO commenced its work on OSI in 1978. "The OSI Reference Model", *Proceedings of the IEEE*, John D. Day and Hubert Zimmerman, Vol. 71 No. 12, pp. 1334-1340, December, 1983.

5 *Information Processing Systems - Open Systems Interconnection - Basic Reference Model - Part 3: Naming and Addressing*, ISO 7498-3, 1988.

6 *Information Processing Systems - Open Systems Interconnection - The Directory - Overview of Concepts, Models, and Services*, ISO DIS 9594-1, 1988.

7 *Message Handling Systems*, Recommendation X.400-Series, CCITT, 1988; and *Information Processing Systems - Text and Office Systems - Message Oriented Text Interchange System*, ISO/IEC DIS 10021, 1988.

8 *Information Processing Systems - Open Systems Interconnection - File Transfer, Access and Management*, ISO 8571, 1987.

9 *Information Processing Systems - Open Systems Interconnection - The Directory*, ISO DIS 9594, 1988; and *The Directory*, CCITT X.500-Series Recommendations, 1988.

10 *Information Processing Systems - Open Systems Interconnection - Transaction Processing*, ISO/IEC DP 10026, 1988.

11 *Information Processing Systems - Open Systems Interconnection - OSI Reference Model - Part 4: Management Framework;* ISO DIS 7498-4, 1988.

12 For example, the *Stable Implementation Agreements for Open Systems Interconnection Protocols*, Version 1 Edition 1, December, 1987, National Bureau of Standards Workshop for Implementors of OSI, NBS SP 500-150; *U.S. Government Open Systems Interconnection Profile (GOSIP)*, Federal Information Processing Standard 146; *UK Government OSI Profile*, Central Computer and Telecommunications Agency, January 31, 1988; *IBM Open Systems Interconnection/File Services Release 1, 288-495, X.400/OSI Message Exchange Offerings, 288-507*, IBM Programming Announcements, September 20, 1988.

13 Op. cit. ISO DIS 9594 and CCITT X.500-Series Recommendations. Also, *Information Processing Systems - Open Systems Interconnection - Specification of Abstract Syntax Notation One*, ISO 8824; and *Specification of Abstract Syntax Notation One*, CCITT Recommendation X.208. *Information Processing Systems - Data Communications - Addendum 2 to the Network Service Definition Covering Network Layer Addressing*, ISO 8348 Addendum 2 and *Network Service Definition*, CCITT Recommendation X.213 Annex A.

14 For example, *Information Processing Systems - Open Systems Interconnection - Procedures for Specific OSI Registration Authorities - Part 4: Registration of OSI Document Types;* ISO/IEC DP 9834-2, May 4, 1988; and *Information Processing Systems - Open Systems Interconnection - Procedures for Specific OSI Registration Authorities - Part 5: Register of VT Control Objects;* ISO/IEC DP 9834-5, April 4, 1988.

15 Op. cit. ISO 7498-3.

16 *Information Processing Systems - Open Systems Interconnection - Procedures for Specific OSI Registration Authorities - Part 1: General procedures;* ISO/IEC DP 9834-1, November, 1987.

17 Ad hoc naming and addressing solutions were recently used during the ENTERPRISE Networking Event '88 International (ENE88i) in Baltimore, MD, in June, 1988. ENTERPRISE

demonstrated the reality of OSI by displaying connectivity among the participating vendors, 61 from the U. S. and 19 from Europe. See *An example of the use of the ISO DCC IDI format to build network addresses under the "USA" DCC*, Enterprise Networking Event, Contribution X3S3.3/88-55, Secretariat: Computer Business Equipment and Manufacturers Association, Washington, D.C., 1988.

18 X.500 Directory Distinguished Names, X.400 Message Handling Systems Private and Administrative Management Domains, ISO 8824 Abstract Syntax Notation One object identifiers, and X.213/ISO 8348 AD2 Network-layer-addresses using the ISO DCC and the ISO ICD formats.

19 Op. cit. ISO 8824/CCITT Recommendation X.208; ISO 8348 AD2/CCITT Recommendation X.213 Annex A.

20 Special Working Group on Registration Procedures in the U.S. of the JTC1 TAG AC Ad Hoc on Registration, *Registration Authority Procedures for Registering Organizations in the United States of America*, Excerpt of X3/88-1437, JT/88-541.

21 Alphanumeric names are created from the set of printable string characters specified in Table 5 of ISO 8824 by the applicant.

22 See section 5.6.

23 The current or pending government regulation of international transborder data flows and cathode-ray terminals are notable exceptions to this laissez-faire approach.